United States
Department of
Agriculture

Forest Service

Forest Pest
Management

Davis, CA

FSCBG/D - The FSCBG Demonstration System User Guide

FPM 95-14
May 1995

FPM 95-14
(C.D.I. Technical Note 94-29)
May 1995

FSCBG/D - The FSCBG Demonstration System User Guide

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1. Summary

This guide overviews FSCBG/D, the demonstration system of the Forest Service Cramer-Barry-Grim aerial spray dispersion model (Teske et. al. 1993). Three pre-computed scenarios may be followed to better understand the capabilities and usefulness of the model. With guidelines presented here, the user can build a unique scenario and demonstration, highlighting specific capabilities of the model for a selected target audience.

2. Introduction

The FSCBG demonstration system, FSCBG/D, is a set of tutorials that provides a look at the capabilities of the FSCBG model. It is intended for both the new user with only passing familiarity with FSCBG and the seasoned FSCBG veteran who may discover new ways to use the model. Three scenarios are included with the demonstration system, giving examples of long-range drift and buffer zone determination, and illustrating the sensitivity of a few inputs. FSCBG's visualization capabilities are called upon to display dosage, concentration, and deposition of the sprayed material. The Total Accountancy capabilities of FSCBG show how to track the fate of all of the released spray. By running through these demonstrations, a potential FSCBG user will see some of the utility of the FSCBG spray model and learn some of the basics of menu navigation.

Unlike FSCBG (Teske and Curbishley, 1990, 1994), where the user navigates a menu system to set up complicated spray scenarios, FSCBG/D relies on pre-computed data files to lead the user through self-paced tutorials. Pop-up windows keep the user informed as to which options are being selected and the meaning of the menu choices. The user of FSCBG/D needs only to press the space bar to keep the demo rolling. While FSCBG/D possesses all the graphical power of FSCBG, the tutorial nature of the demonstrations assures a completely non-threatening experience, even to the "greenest" of FSCBG users.

For seasoned FSCBG users, the demo system is expandable. These users can incorporate their own data with the existing data or create entirely new demonstrations. Note that FSCBG/D is not intended to perform new calculations, so new data must be generated with the standard FSCBG model.

3. Installing the FSCBG demo

FSCBG/D is distributed on one 3.5 inch DOS diskette. This diskette contains a README file which echoes these installation instructions, and a single self-extracting archive with the demo files in it. To install the demo system on your computer, follow these steps: (Note: FSCBG/D requires a total of approximately 3MB of disk space.)

Step 1. Create a suitable directory for the installed files and go there.
(Note: In all that follows in this section, user input appears in bold type.)

Example:

```
C:> mkdir fscbgd
C:> cd fscbgd
```

Step 2. Insert the FSCBG/D distribution diskette in the appropriate drive.

At the DOS prompt, enter:

```
C:> a:install
```

(Substitute the appropriate drive letter if necessary.)

If FSCBG is already installed on the computer and its version number matches the version number of the demo system, the demo system may be installed in the same directory. The executable modules of the demo version are identical to, but are a subset of, those of the standard version. For simplicity's sake however, we recommend that a different directory be chosen for the demo version.

4. How to run the FSCBG demos

As installed, FSCBG/D provides three batch files called DEMO1.BAT, DEMO2.BAT, and DEMO3.BAT. To begin the first demo, "Long-Range Drift," make sure you are in the FSCBG/D directory and type:

```
C:> demo1
```

at the DOS prompt. DEMO2, "Buffer Zone Determination" and DEMO3, "FSCBG Input Variable Sensitivity Demo" are run similarly.

FSCBG/D will start up in just the same way as FSCBG and will run just like it. Indeed, the computer code in the FSCBG/D is very similar to that in FSCBG. Blue information windows will present information on the screen and help pace the walk through the menus and plots. Pressing the spacebar moves the demo to the next window. At the conclusion of each demo, FSCBG/D will exit and return to the DOS prompt. A demonstration may be exited before it is complete by pressing the "Esc" key. FSCBG/D will immediately return to the DOS prompt.

5. What's in the FSCBG demos

Each of the demonstrations presents a problem and shows how FSCBG might assist in solving it. Each of the problems presented is summarized below.

5.1 DEMO 1 Summary

Demonstration number 1, "Long-Range Drift," examines the use of FSCBG to predict the migration of spray material down range of the spray block. The configuration consists of a Turbo Thrush aircraft equipped with six Micronair nozzles flying over a target area at a height of fifty feet. The Thrush sprays Foray 48B which has a volatility of 60%. A 5 mph wind blows at 90 degrees to the spray paths. Concentration, dosage, and ground deposition are modeled up to ten kilometers from the spray block. Total Accountancy shows the portion of the spray material that evaporated, remained aloft, and reached the ground. Table 1 summarizes the demo.

5.2 DEMO 2 Summary

Demonstration number 2, "Buffer Zone Determination," illustrates a method of predicting buffer zone width and spray offset. A Hiller helicopter sprays Accord at a rate of 5 gpa from 25 feet through D8-46 nozzles. A 4 mph wind blows at 45 degrees to the spray paths. The temperature and humidity are 50 degrees F. and 70%, respectively. There is a river to the West of the spray block. Assuming that a level of 1% of the maximum deposition level of the active ingredient is acceptable on the river bank, how far must the spray block be from the river? Table 2 summarizes the demo.

5.3 DEMO 3 Summary

Demonstration number 3, "FSCBG Input Variable Sensitivity Demo", is a short sensitivity study. It demonstrates how changing the value of certain parameters affects FSCBG's predictions. The more sensitive a parameter is, the more we must be sure of its value when simulating real situations. In this demonstration a Hiller Soloy helicopter flies

in a 45 degree crosswind. The release height and spraying speed are varied and the changes are examined. Table 3 summarizes the demo.

6. Writing your own FSCBG demos

This section is intended for users of the full FSCBG model who feel comfortable with the menuing system and workings of FSCBG and would like to write their own demonstration systems. If you are not a current FSCBG user, or are not very familiar with the operation of the model, please skip this section.

6.1 The keyscript file

FSCBG/D has a menu system identical to that of FSCBG. To control this system, the two programs look to different sources of input. FSCBG takes input directly from the keyboard, responding directly to the user's input. FSCBG/D, on the other hand, looks to a keyscript file that contains commands that imitate keyboard input. The keyscript file may also contain commands that display informational windows and control the pacing of the demonstration. The keyscript file is a text file, and can be examined and modified with any text editor. By convention, keyscript files have a file extension of `.kxf`.

The structure of the keyscript file is explained below, and an example follows.

6.2 Keyscript commands

Command lines in keyscript files follow the same basic format:

columns 1-4	command
columns 6-80	arguments

Example: (the following command places text in row 10 column 3 of an open window)

```
wtxt 10  3 this is a message.
```

All commands occupy a single line. The command name consists of a mnemonic of up to four characters, and always begins in column 1. If a command takes arguments, they begin in column 6 and usually follow a very strict format. See the command summary below for the format of each command. Blank lines are ignored. Any line that begins with a pound sign (#) in column 1 is considered a comment and ignored.

When creating a keyscript file, it is important to structure the commands to exit FSCBG/D properly at the end of your demonstration. If FSCBG/D reaches the end of a keyscript file before it exits, the program will end with an error.

6.3 Keyscript command summary

All legal keyscript commands are described below. They must be entered exactly as shown. If a command requires arguments, mnemonic "dummy arguments" show the number and order in which the arguments must be added. With the exception of `message_text`, a dummy argument (e.g. `nnn`) describes the required width of an argument field. Unused columns in an argument must be filled with space characters. Thus, if an argument is described as `nnn`, and the value to be represented is 3, the argument must be entered as " 3" (space-space-three.) `message_text` may be any length, up to 72 characters.

`key  k`

Simulate a regular key. `k` is the key to simulate. A simple way to simulate a key press for printable ASCII characters.

`keya nnn`

Simulate a key by ASCII value. `nnn` is the decimal ASCII code of the key to enter. Useful for non-printable characters like escape (ASCII 27). See Table 4 for a description of some useful ASCII values.

`keyx nnn`

Simulate an extended key by extended ASCII value. `nnn` is the decimal extended ASCII code of the key to enter. Useful for simulating arrow keys (e.g. the down-arrow key is 80) and the like. See Table 4 for a description of some useful extended ASCII values.

`msg message_text`

Display a message at the bottom of the screen. `message_text` may contain up to 72 characters of message. This message appears on line 25 of the screen, starting at column 1. It remains on the screen until a new `msg` command is issued. To clear the message, issue a `msg` command with a blank message field.

`paus nnnnn`

Pause for a specific length of time. `nnnnn` is the length of time, in 100ths of a second, to pause. The pause time may be from 0 to 32767. Suspends processing for the length of time indicated. This command can slow down sections of a demonstration that move too quickly to see properly.

`wopn r1 nr c1 nc bb clr`

Open a message window. `r1` is the starting row for the window. Row 1 is the top row on the screen, and there are 25 rows available. `nr` is the number of rows occupied by the window. `c1` is the starting column of the window. Column 1 is on the leftmost side of the screen and there are 80 columns available. `nc` is the number of columns occupied by the window. The window must fit entirely within the confines of the screen. `bb` is the border style: 0=no border, 1=single-line border, 2=double-line border. `clr` is the foreground and background colors for the window. See Table 4 for a description of color specification. Only one window may be open at a time.

`wtxt rrcc message_text`

Write text at a specified location in an open window. `rr` and `cc` are the starting row and column for the message, relative to the upper left corner of the window. That is, a setting of "`1 1`" would place text in the upper left corner of the open window.

`wclo`

Close the open window

6.4 A sample keyscript file

A sample (and simple) keyscript file is given in Table 5 and explained below. This script is included in the distribution of FSCBG/D in a file called `sample.kxf`. It provides a simple look at the basic building blocks common to all keyscript files: menu navigation, information window presentation, and user interaction.

The first few lines are comments. It is important to record an overview of the keyscript at the beginning, as well as documenting individual sections or steps.

The next three sections, beginning with "`# press return...`" and ending with "`keya 27`," navigate to the file menu, open a data set called "demo1," and return to the Main Menu. In this sample, keys representing menu selections appear in capitals (e.g. `key A`), while keys representing data input appear in lowercase letters (e.g. `key d`). This convention is not a requirement, but it may help to show the programmer's intent.

The next section illustrates the basics of presenting an information window. A blank window is opened (`wopn...`), text is written inside it (`wtxt...`), the script waits for the user to signal to go on (`spac`), and the window is closed (`wclo`). This basic structure remains the same for all information windows, large or small. A pause (`paus`) may replace the `spac` command, but be sure to pause long enough to allow the audience to read the information in the window.

Next (`# open a message...`), the script navigates to, and presents, a preview plot. It is important to wait for user input when displaying a plot so that the audience may completely inspect it. When displaying a plot, an information window may not be open. Therefore it is important to present a window just prior to plotting that includes directions either to wait for the demonstration to continue, or to press the space bar to continue, whichever is appropriate.

Finally, this script, as all scripts should, navigates back to the Main Menu and exits to DOS. This section of the script is important for smooth operation. If FSCBG/D runs out of script commands before it exits, it will exit with an error status. While this condition is not serious, it is a better programming practice to exit gracefully.

6.5 Running a keyscript file

To run the sample keyscript file FSCBG/D is executed with the following command from the DOS prompt:

```
C:> fscbg -k sample.kxf
```

To run a keyscript file with a different name, simply substitute the file name for `sample.kxf`. The full file name must be specified.

Optionally, the "family name" of an FSCBG data set may be specified on the command line. Remember to transfer a data set created by FSCBG to the FSCBG/D directory before trying to use it with the demonstration system. By providing a family name on the command line a keyscript may be run on more than one data set. If this method is employed, care must be taken to make sure that the script will run on each intended data set. For example, to run FSCBG/D with the data set "field1" and the keyscript file "script1.kxf", the following command line is appropriate:

```
C:> fscbg -k script1.kxf field1
```

6.6 Hints on designing a keyscript file

The three demo keyscript files included with FSCBG/D are fairly complex. If you wish to produce you own keyscripts, our advice is to begin by examining and running the sample script given in Table 5. The previous section describes how to run this script. When the user is comfortable with the structure and operation of the sample keyscript file,

he or she may then modify it to suit a new purpose, or begin an entirely new script. Look to the sample script, and its description above, for examples of entering keystrokes, commenting, and presenting windows.

A good method of producing a new keyscript begins with running FSCBG manually on the data set intended for the new demo. Record each keystroke as you navigate through the menu system and exit the program. Then enter the keystrokes in a keyscript file and run it through FSCBG/D (remember to transfer the data set to the FSCBG/D directory first.) When you are satisfied that the keyscript is performing properly, add informational windows, pauses, etc.

During keyscript development, the `paus` and `spac` commands can be employed to slow down or step though a section of script that does not work well. The `msg` command can present debugging messages. Be sure to add comments liberally to your keyscript, as the keystrokes by themselves are hard to follow and understand.

7. Table 1. Long Range Drift Demonstration

Examine air concentration and dosage, and ground deposition up to 10 kilometers downwind. Look at deposition in units of both drops per unit area and mass per unit area. Also use Total Accountancy to examine the fate of all spray material.

MODELS SELECTED

Aircraft Wake Model:	Near Wake (AGDISP)
Evaporation Model:	Selected
Canopy Model:	Not Selected
Dosage Model:	Selected
Concentration Model:	Selected
Deposition Model:	Selected

RECEPTOR GRID GEOMETRY

Grid Orientation Angle: .0 deg

Receptor Grid X Location(s) (m):

.0	500.0	1000.0	1500.0	2000.0
3000.0	4000.0	6000.0	8000.0	10000.0

Receptor Grid Y Location(s) (m):

-10.00	.0	20.00	40.00	60.00
80.00	100.0	110.0		

Receptor Grid Z Location(s) (m):

.0

AIRCRAFT

Aircraft Type: Fixed-Wing Propeller
Aircraft Name: Ayres Turbo Thrush S2R
Aircraft Weight: 2745.5 kg
Aircraft Wingspan: 13.54 m
Planform Area: 28.16 sq m
Drag Coefficient: 1.000E-01
Propeller Radius: 1.296 m
Propeller Efficiency: .8000
Blade RPM: 2000.0
Engine Forward Location(s): 5.153 m

Engine Horizontal/Vertical Location(s) (m):	Horizontal	Vertical
	.0	.0

SPRAY SYSTEM GEOMETRY

Nozzle Forward Location(s): .0 ft

Nozzle Horizontal/Vertical Location(s) (ft):	Horizontal	Vertical
	-14.15	.0
	-7.485	.0
	-4.268	.0
	4.268	.0
	7.485	.0
	14.15	.0

SPRAY MATERIAL

Material Half-Life: Infinite
Density of Carrier: .9970 g/cm3
Carrier: Water
Volatile Fraction of Carrier: .6000
Active Fraction of Carrier: .4000

Mass Size Distribution:	Average Diameter (micron)	Mass Fraction
	93.52	.5402
	160.8	.4040
	232.3	5.304E-02
	307.8	2.504E-03
	387.1	1.280E-04
	470.5	8.643E-06
	Total:	.9999

Minimum Drop Diameter: 5.000 micron

SOURCE GEOMETRY

Spraying Speed: 17.90 m/s
Release Height: 50.00 ft
Emission Rate: 5.000 gal/ac
Swath Width: 18.30 m

Source Location(s) (m):	X Begin	Y Begin	X End	Y End
	.0	.0	.0	100.0
	500.0	.0	500.0	100.0

METEOROLOGY

Vortex Decay Coefficient: .5600 m/s
Surface Pressure: 1013.0 mb
Net Radiation Index: 1.000

Open:	Height ft	Temperature deg c	Rel Humid %	Wind Speed mph	Wind Dir deg
	lavg	5.400	85.00	none	none
	50.00	none	none	5.000	270.0

Averaging Time: 600.0 sec
Gaseous Source Depth: 1.000 m

8. Table 2. Buffer Zone Determination Demonstration

A target area is sprayed according to the above conditions. For a minimum safe deposition level of 1% that of the target area, the minimum width of the buffer zone between the spray block and the river bank is to be determined. Also, an evaluation of whether it is necessary to offset the spray swaths to account for drift is also to be performed.

MODELS SELECTED

Aircraft Wake Model:	Near Wake (AGDISP)
Evaporation Model:	Selected
Canopy Model:	Not Selected
Dosage Model:	Not Selected
Concentration Model:	Not Selected
Deposition Model:	Selected

RECEPTOR GRID GEOMETRY

Grid Orientation Angle: .0 deg

Receptor Grid X Location(s) (m):

-60.00	-40.00	-20.00	.0	20.00
40.00	60.00	80.00	100.0	120.0
140.0				

Receptor Grid Y Location(s) (m):

-33.33	-16.67	.0	16.66	33.32
49.99	66.65	83.31	99.98	116.6
133.3				

Receptor Grid Z Location(s) (m):

.0

AIRCRAFT

Aircraft Type:	Helicopter
Aircraft Name:	Hiller FH
Aircraft Weight:	940.7 kg
Rotor Diameter:	10.79 m
Blade RPM:	394.0

SPRAY SYSTEM GEOMETRY

Nozzle Forward Location(s): .0 m

Nozzle Horizontal/Vertical Location(s) (m):	Horizontal	Vertical
	-4.000	-2.360
	-3.500	-2.360
	-3.000	-2.360
	-2.500	-2.360
	-2.000	-2.360
	-1.500	-2.360
	-1.000	-2.360
	-.5000	-2.360
	.5000	-2.360
	1.000	-2.360
	1.500	-2.360

2.000	-2.360
2.500	-2.360
3.000	-2.360
3.500	-2.360
4.000	-2.360

SPRAY MATERIAL

Material Half-Life: Infinite
Density of Carrier: .9970 g/cm3
Carrier: Water
Volatile Fraction of Carrier: .5000
Active Fraction of Carrier: .2050

Mass Size Distribution: Average Diameter (micron)	Mass Fraction
100.0	.1088
150.0	.2625
200.0	.2986
250.0	.2299
300.0	1.000E-01
Total:	.9999

Minimum Drop Diameter: 5.000 micron

SOURCE GEOMETRY

Spraying Speed: 56.79 m/s
Release Height: 25.00 ft
Emission Rate: 5.000 gal/ac
Swath Width: 20.00 m

Source Location(s) (m):	X Begin	Y Begin	X End	Y End
	.0	100.0	.0	.0
	20.00	100.0	20.00	.0
	40.00	100.0	40.00	.0
	60.00	100.0	60.00	.0
	80.00	100.0	80.00	.0
	100.0	100.0	100.0	.0

METEOROLOGY

Vortex Decay Coefficient: .5600 m/s
Surface Pressure: 1013.0 mb
Net Radiation Index: 1.000

Open: Height ft	Temperature deg f	Rel Humid %	Wind Speed mph	Wind Dir deg
lavg	50.00	75.00	none	none
25.00	none	none	4.000	45.00

Averaging Time: 600.0 sec

Near Wake Calculation Option: Ground

9. Table 3. Drift Sensitivity Factors Demonstration

Release Height: 10 ft and 50 ft
Aircraft Speed: 25 mph and 60 mph

A reference scenario is configured with a Release Height of 10 ft and an Aircraft Speed of 25 mph. The Release height is raised to 50 ft and the effect on the deposition patterns is examined. Then the Release Height is restored to 10 ft and the Aircraft Speed is increased to 60 mph. Again the effect of this change on the deposition patterns is examined. Deposition patterns are examined in units of drops/square cm and oz/ac for all cases.

MODELS SELECTED

Aircraft Wake Model:	Near Wake (AGDISP)
Evaporation Model:	Selected
Canopy Model:	Not Selected
Dosage Model:	Not Selected
Concentration Model:	Not Selected
Deposition Model:	Selected

RECEPTOR GRID GEOMETRY

Grid Orientation Angle: .0 deg

Receptor Grid X Location(s) (m):

-50.00	-40.00	-30.00	-20.00	-10.00
.0	10.00	20.00	30.00	40.00
50.00	60.00	70.00	80.00	90.00
100.0				

Receptor Grid Y Location(s) (m):

-50.00	-40.00	-30.00	-20.00	-10.00
.0	10.00	20.00	30.00	40.00
50.00	60.00	70.00	80.00	90.00
100.0	110.0			

Receptor Grid Z Location(s) (m):

.0

AIRCRAFT

Aircraft Type:	Helicopter
Aircraft Name:	Hiller Soloy Turbo
Aircraft Weight:	1075.5 kg
Rotor Diameter:	10.79 m
Blade RPM:	394.0

SPRAY SYSTEM GEOMETRY

Nozzle Forward Location(s): .0 m

Nozzle Horizontal/Vertical Location(s) (m):

Horizontal	Vertical
-4.000	-2.360
-3.500	-2.360
-3.000	-2.360
-2.500	-2.360
-2.000	-2.360

-1.500	-2.360
-1.000	-2.360
-.5000	-2.360
.5000	-2.360
1.000	-2.360
1.500	-2.360
2.000	-2.360
2.500	-2.360
3.000	-2.360
3.500	-2.360
4.000	-2.360

SPRAY MATERIAL

Material Half-Life: Infinite
Density of Carrier: .9970 g/cm3
Carrier: Water
Volatile Fraction of Carrier: .5000
Active Fraction of Carrier: .2050

Mass Size Distribution: Upper Diameter (micron)	Mass Fraction
56.00	4.500E-03
89.00	6.000E-03
122.0	9.600E-03
154.0	2.830E-02
187.0	3.860E-02
219.0	3.890E-02
252.0	3.990E-02
284.0	5.090E-02
318.0	4.950E-02
351.0	5.530E-02
382.0	6.430E-02
414.0	6.390E-02
447.0	6.100E-02
479.0	5.000E-02
512.0	5.420E-02
545.0	4.510E-02
578.0	5.040E-02
611.0	4.350E-02
644.0	3.040E-02
677.0	3.640E-02
710.0	2.680E-02
743.0	2.820E-02
776.0	2.220E-02
809.0	2.680E-02
842.0	1.780E-02
875.0	2.900E-02
908.0	7.600E-03
941.0	5.300E-03
974.0	2.200E-03
1007.0	7.000E-03
1040.0	1.000E-04
1073.0	1.900E-03
1106.0	4.300E-03
1139.0	1.000E-04
Total:	1.0000

Minimum Drop Diameter: 5.000 micron

SOURCE GEOMETRY

Spraying Speed: 25.00 mph

Release Height: 17.23 ft
Emission Rate: 5.000 gal/ac
Swath Width: 20.00 m

Source Location(s) (m):	X Begin	Y Begin	X End	Y End
	90.00	.0	90.00	100.0

METEOROLOGY

Vortex Decay Coefficient: .5600 m/s
Surface Pressure: 1013.0 mb
Net Radiation Index: 1.000

Open: Height ft	Temperature deg f	Rel Humid %	Wind Speed mph	Wind Dir deg
lavg	50.00	75.00	none	none
25.00	none	none	5.000	45.00

Averaging Time: 600.0 sec

10. Table 4. ASCII Code for use with keyscript files

Useful ASCII codes for the `keya` command:

key	value
Return	13
Escape	27
Backspace	8

Useful extended ASCII codes for the `keyx` command:

key	value
Up Arrow	72
Down Arrow	80
Left Arrow	75
Right Arrow	77
PgUp	73
PgDn	81

Color values for use with the `wopn` command, argument `clr`:

Add a foreground value to a background value to get a color value.
Example: yellow letters on a red background = 14 + 64 = 78

color	foreground	background
black	0	0
blue	1	16
green	2	32
cyan	3	48
red	4	64
magenta	5	80
brown	6	96
white	7	112
gray	8	
light blue	9	
light green	10	
light cyan	11	
light red	12	
light magenta	13	
yellow	14	
bright white	15	

11. Table 5. A Sample Keyscript File

This file may be found in the FSCBG/D directory and has the name `sample.kxf`.

```
# sample keyscript file for FSCBG/D
#
# reads the file "demo1" and presents a preview
# plot of the receptor grid and flight lines.
#
# press return to bypass title screen
keya 13
#
# go to the file menu and read in demo1
key  A
key  A
key  d
key  e
key  m
key  o
key  1
keya 13
# now press escape to return to the main menu
keya 27
#
# Open a message window and explain the next step.
wopn 10  5 30 42  1  48
wtxt  2 3 A preview plot will appear.
wtxt  3 3 Press the spacebar when you're done.
spac
wclo
#
# go into the results menu and present the preview.
key  D
key  A
key  A
key  A
key  A
#
# wait for the user
spac
#
# Now, back to the main menu
keya 13
keya 27
keya 27
keya 27
keya 27
# exit FSCBG/D
key  G
key  B
```

12. References

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